1126 Issued January 11, 1909.

U. S. DEPARTMENT OF AGRICULTURE.

FARMERS' BULLETIN 342.

Experiment Station Work, XLIX.

Compiled from the Publications of the Agricultural Experiment Stations.

CONSERVATION OF SOIL RESOURCES.
POTATO BREEDING.
DISK-HARROWING ALFALFA.
THE MONTREAL MUSKMELON.
STORAGE OF HUBBARD SQUASH.
FIG CULTURE IN THE SOUTH.
MUSHROOM GROWING.
PRESERVING WILD MUSHROOMS.
COOKING BEANS AND OTHER VEGETABLES.
A MODEL KITCHEN.

NOVEMBER, 1908.

PREPARED IN THE OFFICE OF EXPERIMENT STATIONS.

A. C. TRUE, Director.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1909.

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EXPERIMENT STATION WORK.

Edited by W. H. BEAL and the Staff of the Experiment Station Record.

Experiment Station Work is a subseries of brief popular bulletins compiled from the published reports of the agricultural experiment stations and kindred institutions in this and other countries. The chief object of these publications is to disseminate throughout the country information regarding experiments at the different experiment stations, and thus to acquaint farmers in a general way with the progress of agricultural investigation on its practical side. The results herein reported should for the most part be regarded as tentative and suggestive rather than conclusive. Further experiments may modify them, and experience alone can show how far they will be useful in actual practice. The work of the stations must not be depended upon to produce "rules for farming." How to apply the results of experiments to his own conditions will ever remain the problem of the individual farmer.—A. C. TRUE, Director, Office of Experiment Stations.

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ILLUSTRATIONS.

EXPERIMENT STATION WORK.[a]

CONSERVATION OF SOIL RESOURCES.[b]

The conservation of the natural resources of the soil constitutes one of the elemental problems of modern scientific agriculture.

In the United States agricultural operations have generally been conducted without much consideration for the soil inheritance of future generations. Lands have been denuded of trees, and the soils thus more or less exposed have in many localities been washed by torrential rains or melting snows into the rivers, leaving bare rocks behind or soils too deficient in plant food for profitable agricultural purposes. Indifferent methods of cultivation have produced effects similar to those caused by deforestation. In some places rains have frequently washed soils improperly cultivated, while in others winds have drifted the soils, so that at the present time the problem of conserving what is left of the natural resources of the soil is of great economic significance.

The agricultural experiment stations have made efforts to work out the best methods of conserving the natural resources of the soil. A vast amount of work has been done to improve excessively cropped or washed lands by means of the scientific application of fertilizers and the growing of green manures. This, however, is a work of soil building rather than of conserving the forces already in soils, but the following statement of experiments shows that the stations have long been engaged in work looking to the scientific conservation of the natural resources of soils. In this article attention is directed solely to soil conservation as a basis of agriculture, and no consideration is given to the work done by the stations in the conservation of the moisture and plant-food contents of soils.

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[a] A progress record of experimental inquiries, published without assumption of responsibility by the Department for the correctness of the facts and conclusions reported by the stations.

[b] Compiled from Alabama Tuskegee Sta. Buls. 6, 11; Mississippi Sta. Buls. 29, 66, 108; South Carolina Sta. Bul. 32; Tennessee Sta. Bul., Vol. III, No. 4; Wisconsin Sta. Bul. 42. See also U. S. Dept. Agr. Farmers' Buls. 245 and 327.

PREVENTION OF SOIL WASHING.

Soil washing occurs on rolling lands and is generally the result of heavy rains falling on cultivated fields after crops have been removed. The steeper the grade the deeper, usually, are the washed-out gullies, so that after a few years of such washing soils are largely carried away, leaving only bare rocks, a slightly fertile subsoil, or, at best, a soil only a few inches in depth. Such lands are known as "washed" or "galled" lands.

There are various ways for preventing surface washing, such as embanking, tile drainage, deep culture, subsoiling, sodding, and planting to crops.[a] But when soils are washed, two methods of reclamation are generally practiced. The first step is to eliminate the gullies for the better working of the land. This is accomplished by filling with stumps, brush, and an occasional load of earth, and briars and other plants will grow in them. Finally, by plowing and a few embankments, if necessary, the surface can be made smooth by the time the soil is ready for cultivation again. The land is now prepared for the prevention of washing. Observations have shown that plant growth prevents the washing away of soils, and the laying down of such fields in permanent pasture is one method of overcoming the difficulty of washing. Even "the losses which are sustained through the leaching of underground water may be largely prevented, though not entirely. This loss is best prevented by keeping the ground always covered by a growing crop, especially during the fall and winter, when this loss is likely to be greatest. Organic matter and clay have a tendency to fix the plant-food ingredients and prevent their being carried out by the water, and this is the reason that land with a clay subsoil is well adapted to improvement."

Under the conditions which exist, however, in soil-washing regions, the securing of a stand of crops on such lands is an exceedingly difficult undertaking. The Tennessee Station made a large number of experiments during the years 1878 to 1890 with many crops to prevent the washing of the embankments as well as the soil between embankments. Most of these experiments resulted in failure, but the following is a noteworthy exception, as described by the investigator:

> Becoming convinced of the great value of mulch in saving young grass and clover from being scalded out on raw clay exposures during summer, * * * all the sedge grass, weeds, etc., on the place [were] mowed down and stacked up for that purpose during the fall of 1889. During this fall also and the winter succeeding * * * the galled places on the farm not already under treatment were leveled, plowed, subsoiled, and manured at the rate of 20 good

[a] For descriptions of methods of preventing soil washing by means of graded embankments, level embankments, and so-called terraces, see Alabama Tuskegee Sta. Bul. 6, pp. 4, 5; Mississippi Sta. Buls. 66, pp. 13–18; 108, pp. 4–11.

loads of manure per acre on the surface. In the spring of 1890 this was thoroughly worked in with harrow and the whole seeded to clover 6 pounds, red top 1 bushel, bluegrass 1 bushel per acre, with 100 pounds good complete fertilizer per acre. This seeding was killed by a March freeze, and it was reseeded as before, but without any more fertilizers. In May the whole was carefully mulched with sedge grass.

The result was considered a decided success, and the conclusion was that while rather costly, the method altogether, perhaps, furnished the cheapest and most satisfactory means of reclaiming galled hillsides.

Probably the most effective method of conserving the natural resources of washed lands is by means of terracing. Three methods of terracing land have been developed. One is to have a system of level embankments about 4 feet wide and 18 inches high, the rows to be run as near on a level as possible and parallel to the embankments. This method is employed where both the surface and subsoil are porous and absorb water rapidly. It aims to hold the water practically where it falls until soaked up by the soil.

A second system of terracing proceeds on the basis of letting the surplus water run, but by means of rows and embankments make it run slowly. To accomplish this each embankment and each row is given a little fall, the embankments being required to do the bulk of the work. To make this system operate satisfactorily there should be two systems of embankments, the rows running parallel to the main embankments and crossing the shorter ones.

A third system aims at producing, by the method of plowing, real terraces or comparatively level areas on the side or slope of the hillside. To accomplish this lines of level are run the same as in system one, but no embankments are made. A hillside plow that turns all furrows downhill is always used in breaking. Wherever the lines of level have been run, leave an unplowed space 12 to 15 inches wide at each plowing. Let the soil of the first furrow in each terrace space be turned onto the unplowed space, thus elevating this space. If the plow breaks 6 inches deep, the grade or fall of each terrace space or area will be reduced 1 foot every time the land is broke. In carrying out this system the rows are run on a level. It only differs from the system first described in not making an embankment to start with and in the use of hillside plow in breaking.

The perpendicular fall between these terraces should be about 4 feet, and the same is true of the system of level embankments first described. Where both the embankments and rows are given a fall, as described in the second system, the perpendicular fall between embankments may be 8 feet.

The second system, with embankments and rows having a small fall to conduct surplus water slowly, is in use on the [Mississippi] Station grounds. The embankment is essentially a very much enlarged hillside ditch, the bottom of which being 4 to 6 feet wide and the bank from 4 to 6 feet wide and about 18 inches high. This broad, shallow ditch and broad embankment can be crossed with rows and implements and so cultivated as to lose very little land and can be kept as free from weeds and grass as other parts of the field.

The Mississippi Station has reported data as to the cost of making terraces and filling gullies. The former averaged $0.07 per rod,

while all the gullies, large and small, on a badly washed hillside were filled for $5.62 per acre. When it is considered, therefore, that land otherwise useless can be brought under cultivation at a cost of a few dollars per acre, and that by proper care thereafter this land can be kept in good condition with little expenditure of money and labor, the first outlay seems very insignificant compared with the great wealth-producing power thus afforded to a community by these means of conserving the natural resources of the soil.

PREVENTION OF SOIL DRIFTING.

Light sandy soils and sandy loams are often destructively affected by winds. Large tracts of land have been rendered practically useless for the growing of crops, and crops growing in fine condition have been ruined by the drifting of the soil. These conditions apply in many western States where large areas of land covering hundreds of square miles, which experience has proven to be capable of profitable cultivation, are subject to the destructive effects of winds.

The physical explanation of these phenomena is given by Prof. F. H. King as follows:

> Long continuous fields of dry, naked, sandy soil, in hot weather, have a peculiar effect upon the air currents sweeping across them. The sand itself becomes very hot and greatly expands the air coming in contact with it, making it relatively lighter than the colder, much more rapid current of air sweeping along above, and the result is the warm air suddenly blisters, as it were, and being lifted from the ground, a cold current of rapidly moving air from above strikes obliquely upon the surface, raising a cloud of fine dust into the upper swifter current in which the particles are borne away, while the coarser grains are rolled along the surface until the air is slowed down by its friction upon the ground. This air coming down from above has a peculiar parching effect, too, for it is naturally drier than the ground air and, striking the hot soil, its parching power is greatly augmented by the heat it so receives. Grass-covered surfaces and damp soils do not become overheated as the dry sands do, and the result is, during windy times, the air moves across them in a more steady and less turbulent manner.

In consequence of such conditions occurring over extensive areas of soil in parts of Wisconsin Professor King, of the Wisconsin Station, made a careful study of the influence of shelters and methods of cultivation as means of protecting the fields. From these investigations the following practical suggestions are made regarding the conservation of these lands for agricultural purposes:

1. **Frequent rotation in long, narrow lands.**—If light soils are cultivated in long, narrow lands, not wider than 15 to 20 rods, alternating with similar strips of grass, preferably clover, such destructive effects as above indicated can not occur, or only to a slight extent. If possible, the fields should extend in a north and south direction rather than east and west. The nature of the lands renders cultivation

one way satisfactory and a saving of labor. The rotation should aim " to always have in the spring a field of grass to the west of those which are to be sowed to grain and seeded to clover, and this is secured by always planting potatoes or corn on clover sod, for the latter going in later in the season allows the clover to stand as a protection while the grain is getting started when the most serious damage is done and at the same time furnishes a green manure to plow in to increase the humus of these soils, in which they are naturally so deficient."

2. Increasing the water-holding power of the soil.—The small water-holding power of these soils is the cause of drifting, and makes it difficult to get and maintain a good stand of clover. Moreover, the more these fields are allowed to drift the less their water-holding power becomes and the greater their tendency to drift in succeeding years. The presence of organic matter in the soil increases its water-holding power, so that the use of plenty of barnyard manure and the plowing under of green crops and weeds are recommended.

3. Leaving the ground uneven after seeding.—The smoother the ground the greater is the velocity of the wind close to the surface and, therefore, the greater is the power of the wind to take up and carry away the soil particles. Observations show that fields left smooth after seeding drift badly, while in uneven fields there is no appreciable drifting. Running a harrow over smooth fields stops drifting at once where the soil is stirred. Sowing the seed with the drill north and south also has a tendency to lessen drifting very materially.

4. The preservation of wooded belts in north and south strips.—Where clearing is being done, strips running north and south should be left as windbreaks to stop the drifting and to make sure a crop of clover or grass. " The width of the wooded strips to be left as hedgerows would depend upon the character of the soil and upon the width of the strips that are cleared; the lighter the soil is and the wider the cleared fields the broader the hedgerows should be."

5. The planting of windbreaks.—Planting of trees on the section and quarter section lines of prairie lands, on roadsides, along the borders of fields, and as shelter belts on light lands that have been entirely cleared of trees is recommended. Trees that do well on light soils are box elders, jack pines, apples, plums, English filberts, etc.

Considered in its general aspects, the work which the agricultural experiment stations have done along the lines of preventing the washing and drifting of soils is of great economic significance. Means for preventing the further waste of the natural resources of the soil have been discovered. If these principles are put into practice, large tracts of land now useless can be brought under cultivation, and if these

lands are worked in accordance with methods of restoring and maintaining soil fertility, which the stations and this Department have discovered and published, the extent of the wealth-producing power thus conserved to the farmers of the United States will be enormous.

POTATO BREEDING.[a]

In total value of annual production the potato crop usually ranks sixth among our field crops, standing between oats and barley. The yearly consumption of potatoes increases as the population grows, and not infrequently the annual imports exceed the annual exports. Further, in only six years since 1866 has the average yield for the whole country been over 100 bushels per acre, while ordinarily this is considered a small yield, especially by market growers. The importance of the potato crop, therefore, as well as the comparatively low average yield per acre would seem to warrant the use of improved methods to increase the annual production. In addition to employing improved cultural methods, this may be accomplished by improving the productivity of the crop.

Dr. H. J. Webber, in a recent bulletin of the New York Cornell Station, points out that even for New York State alone every means should be used to increase the production, and among other results those secured by Prof. C. W. Waid, of the Ohio Experiment Station, indicate the possibility of greatly improving the crop by tuber or bud selection. Professor Waid's work was begun in 1903, and the results obtained during three years are here summarized:

In 1904 10 hills each were planted from seed selected from 10 heavy yielding hills, and likewise 5 hills each from seed selected from 20 low-yielding hills of the crop of 1903. These 100 hills of each group were compared with 100 hills planted from seed not selected with reference to individual hills. In 1905 and 1906 this was repeated, the seed having been selected respectively from the high-yielding and low-yielding hills of the preceding year's crop. The results are briefly given in the following table:

Results with seed potatoes from high-yielding and low-yielding hills of Carman No. 3.

Source of seed.	Yield of 100 hills.				Number of tubers in 100 hills.			
	Total, 1904.	Total, 1905.	Total, 1906.	Average, 1904–6.	Total, 1904.	Total, 1905.	Total, 1906.	Average, 1904–6.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*				
High-yielding hills	125	173	116	138	781	865	676	774
Check rows	115	136	79	110	713	630	479	607
Low-yielding hills	84	75	61	73	566	546	364	492

[a] Compiled from New York Cornell Sta. Bul. 251; Ohio Sta. Bul. 174.

The average yield of the 100 heavy hills was 138 pounds as compared with 110 pounds for the unselected seed and 73 pounds for the seed tubers from the light-yielding hills.

As environment has a great influence on the potato, Doctor Webber advises that farmers, especially those growing potatoes extensively, determine by test the variety best suited to the locality or even to the particular farm on which the crop is produced. When the best variety available has been found a good foundation for breeding work has been laid. In fact, in plant breeding the variety or strain with which breeding work is begun is known as the foundation stock. The use of the following method is urged by Doctor Webber for carrying on the work from this point:

(1) Examine a large number of tubers of the variety selected as the foundation stock and decide on the most desirable shape and type of tuber. In general a moderately large tuber, which is oblong or somewhat cylindrical in shape and oblong in cross section is considered most desirable. A spherical tuber if sufficiently large to be desirable is so thick that in cooking the outside is liable to become overdone before the interior is properly cooked. A tuber with shallow eyes, netted surface, and white color is also usually preferred.

(2) When the ideal character and size have been determined, examine a large number of tubers and pick out a thousand or more having this size, shape, and general character. * * * These are to be used as the seed for planting the selection plat and the number selected should correspond to the size of the plat which it is desired to plant, four hills being planted with each tuber. There should certainly not be less than 1,000 and a much larger number is very desirable. The prospective breeder should remember that success in breeding work depends upon selecting the one individual that gives the very highest yield possible under the conditions, and the larger the number of individuals examined the more likely is he to discover the one producing the maximum yield which will give a valuable new strain. * * *

(3) The planting should be arranged in such a way as to secure a test of the productivity of each tuber. * * * Cut each tuber into four uniform-sized pieces, making each cut longitudinally so that each piece will contain an equal proportion of the basal end and apical end of the tuber. Plant four hills with each tuber, one piece in a hill. These should be planted consecutively in each row, beginning at one end, so that starting at that end the first four hills will be from one tuber, the second four hills from another, and so on throughout the length of the row. The object in planting this way is so that the four hills can be dug together and the total product weighed to obtain a measure of the productivity of the seed tuber planted. Probably the best way to plant these is to drop the selected tubers one to each four hills and then go over the row and cut each tuber and plant its quota of four hills. The hills in the row should be planted somewhat farther apart than in ordinary planting, probably from 20 to 24 inches. If this is not done a somewhat greater distance than ordinary should be left between each 4-hill tuber unit. The writer would advise that one hill be left unplanted between each 4-hill unit. It would doubtless be convenient and desirable to have the plants in rows both ways to facilitate digging. For this selection plat of potatoes choose a field of moderately good fertility and as uniform throughout in soil as is possible to obtain.

The breeding plat is fertilized and cultivated exactly like the ordinary crop. When the vines begin to mature, but while they are yet green, the 4-hill units showing the most vigorous growth and at the same time freedom from or at least resistance to disease are selected and marked, preferably with a stake. Later each 4-hill unit which is the progeny of one tuber is dug separately and the tubers of the four hills are carefully kept together. If the particular tuber unit is marked as one of the best, the same stake may be used to mark the product. When the entire crop of the breeding plat is dug, the 50 to 100 tuber units best in yield, uniformity of product, color, shape, etc., are selected. For this work the following directions are given:

(1) Go over the field and study the tuber units in a gross way until you have well in mind the variations in yield and the general uniformity of the tubers in the various tuber units. Remember that total yield is not the only important character. What one wants is to discover those tuber units which have the largest yield of good merchantable potatoes of the best shape and appearance. Size up the field as a whole with reference to these characters.

(2) Go over each row carefully and throw out all of those tuber units which can be clearly seen to be inferior. * * * For the interest of the grower, however, it would be well to weigh the product from some of the light yielding tuber units and preserve the figures as a matter of showing the extent of variation occurring. By this first discarding process the number of tuber units will probably have been reduced to two or three hundred. It is very probable that in some cases one or more of the hills of a 4-hill tuber unit will not grow. In such cases the tuber unit will have to be judged in proportion to the number of hills actually grown.

(3) Now, provide yourself with scales of some handy pattern like the ordinary counter scales used by grocers, with which the product of each tuber unit can be easily and quickly weighed. A satisfactory scale should weigh accurately to at least a half ounce. Weigh the product of the remaining tuber units, examine the tubers more carefully as to their character and uniformity of size in the tuber unit, and select about fifty of the best units. These fifty units should naturally be from those marked as having good healthy vines in the first examination, before digging, unless all of the vines at that time were in fairly good condition. In making these final selections if some hills in a tuber unit are missing the comparative yield can be easily calculated. If one hill is missing, a comparative yield for four hills is obtained by increasing the weight from the three hills by one-third. If two hills are missing, a comparative yield for four hills would be double that obtained from the two hills. If more than two hills are missing, discard the unit entirely.

The product of the tuber units selected should then be placed in paper bags, the product of one tuber unit being placed in a bag. A good bag for the purpose is the 12-pound manila paper bag used by grocers. Number each tuber unit consecutively and place this number on the bag. In your notebook record under the number of each tuber unit the number of large, medium-sized, and small tubers, and the total weight of the product. The bags containing the seed should then be placed in suitable storage where they will not be torn and the tubers mixed. The tubers from the best discarded tuber units should be retained to plant the general crop the next year.

For the second year's planting of the breeding plat the 10 best tubers of each of the 50 select tuber units, as judged by the standard type of tuber, are selected. Each tuber unit is planted in a row by itself, and as each tuber is cut longitudinally into four equal-sized pieces, the 10 select tubers will make a row of 40 hills, and if 50 tuber units were selected the breeding plat would contain 2,000 hills. Each row receives the number of the tuber unit from which it is planted. About every tenth row may be planted with unselected seed for comparison. The selections are made the same way as the year before. At the time of digging the yield of each unit is weighed and the number of large, medium, and small tubers recorded. This record will show the tuber unit of the original selection which has given the best results. The 50 best tuber units are again selected, the tubers of each kept separately in a paper bag and each bag numbered with the number of the original tuber unit, which is also the number of the row, and with the number of the tuber unit of each row as grown in this year's plat, as follows: 1–1, 1–2, 1–3, etc., for the tuber units from the first of the 40 rows; 2–1, 2–2, 2–3, etc., for the second row, and so on to the units of the last row, numbered 40–1, 40–2, 40–3, etc. The performance record of each tuber unit should be associated with its number.

All the good tubers of the tuber units not selected should be used for planting a multiplication plat the third year, from which enough seed can be grown to plant the general crop the fourth year. The ten best tubers of each selected tuber unit are again picked out for planting the next year's breeding plat.

The third year the breeding plat is planted according to the same method just described for the second year. The multiplication plat which may be grown this year does not require any special method of cutting and planting the tubers, as any desirable method will do. In the fourth and succeeding years the work is continued along the lines laid down.

It is pointed out that as heavier-yielding strains appear all further selections should be made from these strains, and that in this way, as the work progresses, many of the original strains will be entirely discarded. As an illustration of the appearance of such strains, further results obtained by Professor Waid, as given in the table below, are presented. The figures given for 1905 and 1906 represent the average yield of original and duplicate tests.

Yields from seed selected from high-yielding hills of Carman No. 3 potatoes.

Hill No.	Yield of selected hills, 1903.		Total for 10-hill group, 1904.		Total for corresponding 10-hill group, 1905.		Total for corresponding 10-hill group, 1906.		Average 10-hill groups, 1904–6.	
	Lbs.	*Oz.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*
1	2	8.0	13	12.0	16	3.0	9	4.8	13	1.3
2	2	13.0	15	4.5	15	9.0	9	.5	13	4.7
3	2	10.5	12	1.5	18	3.0	10	14.0	13	11.5
4	2	2.5	11	15.0	17	11.0	11	1.8	13	9.3
5	2	3.0	12	8.5	16	9.0	11	10.3	13	9.3
6	2	1.0	10	9.5	15	.0	14	3.3	13	4.3
7	3	1.0	13	8.5	18	7.0	15	11.0	15	14.2
8	2	7.0	10	11.5	18	1.0	13	4.3	14	.3
9	2	1.5	12	14.5	19	10.0	11	6.0	14	10.2
10	1	14.0	12	0.5	18	8.0	10	5.0	13	9.8

The table shows that hill No. 7, which had the highest yield of the original ten hills selected, in each of the three years gave a very high yield and the highest average yield for the three years.

It seems evident from these results that by the simple method of selecting seed potatoes from the most productive hills for a series of years the productiveness may be profitably increased. The farmer can hardly afford to neglect so easy and efficient a means of increasing his profits, but will undoubtedly find it to his advantage to study the practical methods most applicable to his particular conditions.

On this point Doctor Webber says:

For many years farmers have given careful attention to the methods of seeding, cultivation, manuring, and the like, but have generally neglected to give any careful attention to the methods of seed selection or breeding. They have universally recognized the importance of stock breeding and on all dairy and stock farms more or less careful attention has been given to the matter of breeding and improvement of the strain grown. To every farmer the field of breeding, whether in plants or animals, furnishes an interesting and profitable diversion. Plant breeding especially should become a farmer's fad. Few can afford to breed animals in the extensive way necessary to secure important results, owing to the expense. No farmer, however, is so poor but that he can have his breeding patch of corn, wheat, or potatoes. Indeed, if they but knew it, they can ill afford not to have such a breeding patch to furnish seed for their own planting.

DISK-HARROWING ALFALFA.[a]

The disking of alfalfa is a common practice, and seems to be an especially effective means of destroying weeds and breaking up the silt blanket deposited in cases where muddy water is used for irrigation. The ordinary disk harrow is widely used for this purpose, but R. H. Forbes, in a bulletin of the Arizona Station, states that a special machine " for the cultivation of alfalfa has been devised on the principle of the disk harrow, but with rows of strong spikes

[a] Compiled from Arizona Sta. Bul. 57, p. 256; Kansas Sta. Bul. 155.

or digging teeth in place of the continuous edges of disks. These machines are stated to be in successful operation in Australia and South Africa, and one form * * * was introduced into Arizona in 1907. * * *

"One man with an 8-foot machine and four horses will get over 8 to 10 acres of alfalfa in a day. This work may be done in winter when teams are more at leisure; but it is probable that in summer also, after cutting and before irrigating, an occasional disking, to break up the sediment blanket, may be well worth while, especially on the upper ends of alfalfa fields."

In South Africa the necessity of disk cultivation is recognized to the extent of having contests in which prizes are given for the machine most closely meeting the requirements.[a]

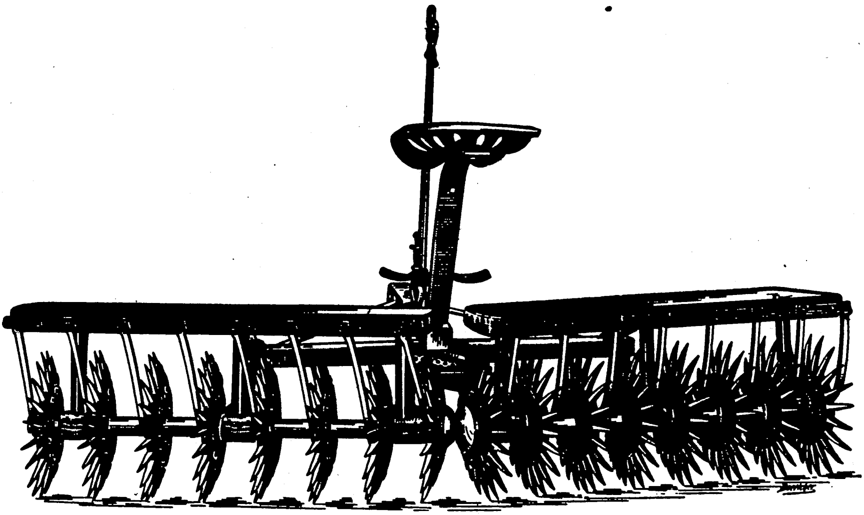

FIG. 1.—The alfalfa harrow.

A. M. Ten Eyck, of the Kansas Station, considers the cultivation of alfalfa desirable, and recommends disking in the early spring. He found "that less injury was done the alfalfa and the best work accomplished by setting the disks rather straight and weighting the harrow so as to make it cut 2 or 3 inches deep;" then cross-disking the field and harrowing it with the common straight-tooth harrow. He states that "the common disk-harrow is more generally used than any other implement to cultivate alfalfa, and when properly adjusted does good work. The spike-tooth disk, known as the 'alfalfa harrow' [fig. 1], was used on the alfalfa fields at the experiment station farm during the seasons of 1907 and 1908. This harrow does good work when properly adjusted, and is perhaps a better implement for this purpose than the common disk-harrow."

[a]Agr. Jour. Cape Good Hope, 32 (1908), No. 4, p. 458.

The ends attained by disking alfalfa are thus concisely stated by Professor Forbes:

At a trifling cost, varying according to individual circumstances, the disk-harrow splits and spreads the crowns of alfalfa plants, causing them to develop additional tops; it destroys the egg deposits and larvæ of certain injurious insects; it destroys weeds; it breaks up the silt blanket resulting from the use of muddy irrigating water, allowing better penetration of water and air to the roots of the crop; it loosens up certain dense soils; and to some extent it incorporates beneficial sediments and fallen alfalfa leaves with the soil.

As one of the most serious obstacles to the successful culture of alfalfa, particularly in the Eastern United States, is the crowding out of the plants in the earlier stages of growth by weeds, the introduction of implements and methods which will destroy or control the weeds is of great importance. The use of the disk harrow as described above seems to offer an efficient and practical means of securing this result.

THE MONTREAL MUSKMELON INDUSTRY.[a]

In a recent bulletin of the Vermont Station, Prof. W. Stuart states that for years a few Canadian muskmelon growers have enjoyed an almost exclusive control of the large eastern markets of the United States for their product. These growers, through carefully selected stock and skillful cultural methods, are able to produce a melon of unusual excellence over a season extending from the middle of July to frost. These melons command fancy prices ($8 to $15 per dozen wholesale), and even at such prices the Canadian growers are not able to supply the American demand.

It is quite generally believed that the Montreal muskmelons can be grown successfully only on a certain limited area on the island of Montreal. While the conditions of soil and climate may be especially favorable there, it seems reasonable to think that much of the success of the Canadian growers is due to their willingness to take infinite pains at every stage of this crop and that American farmers in the States bordering on Canada can perhaps be equally successful if they are willing to be equally painstaking.

It is recognized, however, that the crop "is an expensive and precarious one to grow, owing to frequent recurrence of unfavorable seasons and to the extreme care required to grow it successfully."

Professor Stuart states that "the cultural methods employed by Montreal growers are essentially as follows:

The seed is sown in the greenhouse or hotbed from late February to early April; later they are potted up into 3 or 4 inch pots, and when in danger of suffering for lack of root space and plant food and the weather is favorable they are removed to sash-covered frames, there to remain until they are almost

[a] Compiled from Vermont Sta. Rpt. 1907, p. 358; Bul. 136.

fully grown. These hotbeds are well constructed, well exposed to the sun, and also protected from cold winds. The frames are often covered with two sets of sash, mats, and board shutters. With such protection, if horse manure is used to generate a sufficient bottom heat and the exposed portions of the frame are banked therewith, the plants may be grown almost as well as in a greenhouse. These frames are movable sections approximately 12 by 6, strong and tight with tie rails for the sash to slide upon.

The soil over which these sections are set is ridged up in beds 12 to 16 feet wide with a 1-foot center elevation. A trench is dug 2 feet wide, 15 to 18 inches deep, and filled almost level with well fermenting manure, and a portion of the surface soil thrown over it, slightly more being drawn in where the plants are to be set. The frames are then set in place and covered with sash, which in turn are further reinforced with mats and wooden shutters, or hay or straw with or without the shutters. A 4 to 6 foot space is allowed between the ends of each section. When the soil over the manure is well warmed up, the warmest portion of some favorable day is selected for planting. Great care is exercised now in transferring the plants from the hotbeds to guard against setbacks from sudden changes of temperature or soil conditions. The coddling process does not cease now. It is simply spread over a greater area and the plants require even closer care than before, for greater attention must be paid to watering, syringing, and ventilation, success at this stage being very largely dependent thereon.

As the fruit attains size, it is usually lifted from the soil by a shingle or flat stone, to avoid loss from cracking, rot, etc. Uniform shape, color, netting, and ripening is secured by turning the fruit every few days. When the runners fairly occupy the inclosed area the frames are raised a few inches. As the season advances more and more air is admitted until, finally, when the melons are almost full grown, the sash and then the frames themselves are entirely removed.

As each fruit sets its shoot is pinched off one or two joints beyond it. A 15 to 20 melon crop is considered sufficient from each 6 by 12 frame. Three or four hills are planted and usually two plants are set per hill.

The melons vary greatly in size. One weighing 44 pounds has been grown. The writer saw one weighing 22 pounds, which had been selected for seed purposes. Their average weight ranges from 8 to 15 pounds, and a dozen averages from 120 to 130 pounds. In exceptional cases some have been shipped weighing 240 pounds per dozen package. The larger melons are apt to be poorer in quality than those weighing 8 to 15 pounds.

Two distinct types exist, a roundish oblate and an oblong, the first slightly deeper ribbed than the latter. These do not seem to be separated by the growers. It is not at all certain that either type is fixed.

A large wicker basket (clothes basket) is commonly employed in shipping to distant markets. They hold a dozen melons, packed in short, fine-stemmed hay, and are shipped without cover, no attempt being made to fasten the melons in place, the express company being held responsible for safe delivery.

Believing that there is no valid reason why American growers, under conditions similar to those of Montreal, should not succeed in producing these melons and that "a crop which may net $1,000 to $2,000 per acre is worth an effort to produce," the Vermont Station has undertaken experiments to determine the conditions and methods necessary to success. The first season's experiments, for various reasons which are explained, were not very successful, but Professor

Stuart states that "the knowledge secured in the handling of the crop justifies the assumption that there is no valid excuse for continuous failure on the part of American growers to produce these melons successfully."

STORAGE OF HUBBARD SQUASH.[a]

In view of the fact that the conditions controlling the losses in storage of vegetables are not very well understood, and that the advisability and profitableness of storage of vegetables for a later market depend largely upon the extent and character of such losses, Prof. W. Stuart, of the Vermont Station, undertook experiments to determine the loss of moisture and from decay sustained in storing Hubbard squash till midwinter, as well as the profitableness of such storage:

[In these experiments a ton of squash] weighed as taken from the field, was stored on October 3 in a dry and medium warm (50° to 60° F.) room. On December 4 it weighed 1,810 pounds, a moisture loss for two months of 9.5 per cent. On January 4 it weighed 1,657 pounds (sound 1,622, decayed 35), a moisture loss of 8.5 per cent and a decay loss of 1.8 per cent. On February 3, four months from the harvest, the sound squash weighed 1,488 pounds, and the decayed 61 pounds, a moisture loss of 4.5 per cent and a decay loss of 3 per cent. The total moisture loss during four months was 20.8 per cent and that from decay 4.8 per cent; total, 25.6 per cent. * * *

When the squash were put in storage they were wholesaling at 1 cent per pound, late in October at 1.5 cents, 2 cents late in December, and in January, owing to unusual scarcity, at 2.5 to 3 cents. At the conclusion of the trial the 1,488 pounds were sold for $53, an average of over 3½ cents per pound, the net gain by storage being $33 per ton. Market conditions, however, were very unusual. The common price at harvest is $15 to $20 per ton, and does not materially increase until January ($30 to $40), while during February and March they advance to $50. Hence, even under ordinary conditions the increase in price amply offsets losses from moisture, decay, and cost of storage, and leaves a handsome profit.

The conditions tending to minimize losses in storage are stated to be—

(1) The squash should be well matured before harvest.

(2) They should be cut or carefully broken from the vine, leaving the stem attached to the squash.

(3) If possible, they should be placed in small piles to ripen and harden up for two or three days before hauling from the field.

(4) They should be hauled in a spring wagon, the box of which is lined with burlap or other material, to prevent bruising.

(5) The storage room should be dry and moderately warm at least for the first two weeks, to harden up the shells, after which a lower temperature, provided the room is dry, may be maintained.

(6) Finally, squash from harvest to sale should be handled as one would handle eggs. Broken stems and bruised skin are sure to cause decay.

In general, Professor Stuart concludes that "squashes properly grown and handled may be held in storage till midwinter or later

[a] Compiled from Vermont Sta. Rpt. 1907, p. 367; Bul. 136.

with a reasonable assurance that the moisture and decay loss will be amply covered by the increased price received."

There is an additional advantage to be considered, viz, that if the squashes are stored a saving of time may be effected and the hauling to market done at a time when farm work is less urgent.

FIG CULTURE IN THE SOUTH.[a]

The fig tree has been widely though not extensively grown for many years in practically all of the Southern States. Its greatest development is in the Gulf coast region, where it was probably introduced in early times by the French and Spanish. There and along the South Atlantic coast it grows in the open without winter protection, bearing at an early age, and abundantly on soils adapted to its culture. In unusually severe winters the trees may be frozen to the ground; but if the root system has been well established, sprouts will spring up, grow rapidly, and bear in the following year. Under

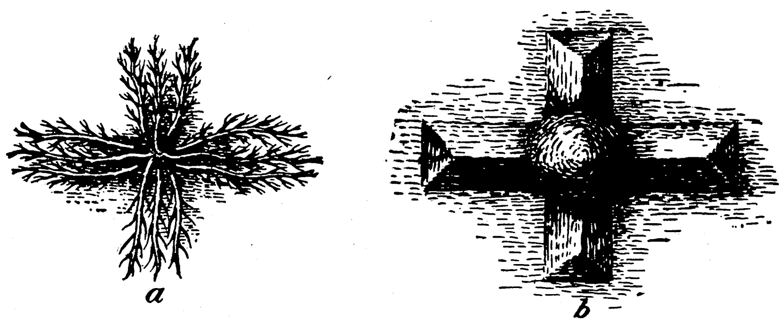

FIG. 2.—Winter protection of fig tree: *a*, Fig tree bent to the ground ready for covering; *b*, fig tree covered with earth.

these conditions the tree appears as a large bush. Away from the coastal sections an annual crop is best assured by growing hardy varieties and giving some form of winter protection. The use of the bush or stool form from the start is advisable where there is frequent danger of winterkilling. W. F. Massey, of the North Carolina Station, writes as follows on the winter protection of the fig:

> On the coast, in the immediate vicinity of salt water, it will need no winter protection. But in the cold western part of the State the method I have found successful in Maryland will do equally well. This is to branch the trees from the ground, and in fall, after the frost has cut the leaves, bend down the branches to the ground and pin them fast, and then pile the earth over them, mounding it over the center and sloping to the outside so as to throw off the water, or gather the limbs like a cross on the ground and cover each bunch separately with a higher mound in the center like a four-pointed star. [Fig. 2.] They will keep perfectly in cold climates in this way.

[a] Compiled from Alabama College Sta. Bul. 112; Georgia Sta. Bul. 61; North Carolina Sta. Bul. 184; Tex. Sta. Bul. 62; U. S. Dept. Agr., Div. Pomol. Buls. 5, 9. See also Georgia Sta. Bul. 77; Louisiana Sta. Bul. 90.

He found that trees which are buried and covered with earth in the somewhat milder sections are apt to rot in the warm and rainy weather during winter.

Here the best way possible, though very tedious and troublesome, is to thatch each limb and the stem thickly with broom sedge, wrapped on with cotton twine. This is the best protection I have ever tried; but the bending down and covering with pine boughs usually answers very well. Where the trees are to be bent down and covered, it will be necessary to plant them 20 feet apart each way, in order to give room for the covering. With the earth cover it is more certain to have good crops of figs in a cold climate than here without protection.

Relative to the use of wind-breaks, H. N. Starnes, of the Georgia Station, says:

A good location for a fig row, on a small scale, will be found upon the south or east margin of a protecting strip of woods, though not so near the trees, of course, as to permit them to rob the figs of their own moisture and plant food. A close board fence or a building makes an excellent wind-break. In lieu of these a hedgerow of Cherokee or Macartney rose, or of Osage orange (where the latter chances to thrive) will serve. A double row of closely set Carolina poplar makes a good substitute on account of its inexpensiveness and rapid growth—for it propagates from cuttings even more readily than the fig itself and grows much faster. As it is deciduous, however, it serves only partially as a protection at the time protection is most needed. Some such evergreen material as Amoor River privet, though not so rapid in growth, is a more perfect wind-break. At the Georgia Experiment Station a row of Deodora cedar is employed for this purpose, but it requires some years to establish it, and it is not to be recommended for general use.

Even farther south, where the tree is grown as a standard and the weather is only severe during occasional winters, some form of protection is advisable for the first three years. After this period the trunk of the fig is less easily injured by cold.

That the fig has not long since been developed as a commercial fruit may be attributed chiefly to the inability thus far to produce a marketable dried fig, the fig of commerce, in the humid southern climate. Moreover, the fresh fruit, which is highly esteemed both by those who grow it and those who have acquired a taste for it, is practically unknown in large commercial centers, being an extremely poor shipper. In a previous bulletin of this Department, F. S. Earle,[a] of the Alabama Station, says, in part, relative to the shipment of fresh figs:

Fresh figs are not known or appreciated in northern markets, and consequently the demand is too limited to encourage shipments. It seems doubtful if the distant shipment of fresh figs will ever become a profitable business. The fruit is more perishable than any other that is generally marketed. It can be handled only by the most careful and experienced persons, and even then it is not in a condition to show its best quality. Ripening in midsummer, when the northern

[a] U. S. Dept. Agr., Div. Pomol. Bul. 5.

markets are crowded with many well-known fruits and not being especially attractive to the eye, fresh figs would at best gain favor slowly.

As a domestic fruit, however, the fig is of prime importance, for in addition to its use direct from the tree, it may be either canned or made into jams, jellies, or preserves. It is a wholesome fruit and in the older fig-growing countries is an important food. The fig should never be eaten until thoroughly ripe, since green figs contain an acrid milky juice which not only has a disagreeable flavor but is unhealthful. This trouble disappears when the fruit is ripe.

Relative to the use of the fruit for domestic purposes, Earle says:

> They are eaten fresh from the tree or are served on the table with sugar and cream. They can also be stewed and made into puddings and pies, and when canned or preserved they make an acceptable table delicacy throughout the year. * * *
>
> For canning, figs should be picked when still firm enough to hold their shape. To secure the best results they require the use of more sugar than do some other fruits. If undersweetened they seem tasteless and lacking in quality. The amount of sugar used and the method of procedure vary greatly in different households. A pound of sugar to three or four pounds of fruit would probably suit most tastes, though some prefer the regular "pound for pound" preserve. Ginger root or orange peel is sometimes added to give variety of flavoring, and figs are often made into sweet pickles by adding spices and vinegar. Figs are sometimes peeled before canning, and this is considered to increase their delicacy of flavor. More frequently, however, they are cooked unpeeled and with the stems on, just as they come from the tree. They hold their shape better and look more attractive when treated in this way, and the difference in flavor, if any, is very slight.
>
> Figs are occasionally dried for household use, but as they ripen at the South during the season of frequent summer showers, this is so troublesome that it is not often attempted. A nice product could doubtless be made by use of fruit evaporators, but these are seldom used far south.
>
> In speaking of home uses for the fig, its value as food for pigs and chickens should not be forgotten. Both are very fond of them, and on many places the waste figs form an important item of their midsummer diet. In fact, no cheaper food can be grown for them.

The future commercial development of the fig in the South probably lies in the shipment of selected fresh figs to the larger towns within 200 or 300 miles from the source of production, and in the consumption of the surplus crop and inferior grades by the canneries. Figs have been canned on a small scale for many years in lower Mississippi and Louisiana, and the industry is now being extensively developed along the Texas coast. The canned product is liked by everyone, and the present limited output is disposed of at high prices. According to recent press reports from Texas, several hundred thousand fig trees will be planted by farmers and truck growers in the coast country of that State during the coming winter. The price now paid by the canners for figs is given as $60 a ton, or an average of $150 to $200 an acre for the crop from a 4-year-old orchard.

The fig will grow in a variety of soils and is generally adapted for dooryard and garden conditions, flourishing with little care or attention. There is a scarcity of experience in the South relative to its culture under field conditions. It requires an abundance of plant food, however, and is relatively a surface feeder, the depth of the feeding roots depending to a great extent on the distance to moisture. It reaches its highest development on a fertile, moist, but well-drained loamy soil, containing an abundant supply of lime. In general, lowland soils which do not overflow, or which can be readily drained to a depth of three or more feet, will prove ideal for the fig orchard.

The trees will make satisfactory growth on fertile soils without the use of additional plant food. If either lime, phosphoric acid, or potash is lacking, it should be liberally supplied, especially when the trees reach the bearing age. Starnes, of the Georgia Station, says:

> A good annual mulch of well-rotted lot manure is the best fertilizer that can be given the fig—supplemented when the trees are of bearing age and the growth of wood is lusty and vigorous by the addition of phosphoric acid and potash. * * * Five pounds of acid phosphate and 2 pounds of muriate of potash per tree, broadcast, would not be too much. Eight pounds of kainit or a peck or so of hardwood ashes may be substituted for the muriate of potash if desired. * * * From 5 to 6 pounds per tree of air-slaked lime would prove profitable; but it should be applied separately and never in conjunction or mixed with either the lot manure or the commercial fertilizer.

On the other hand, as R. H. Price and E. A. White pointed out in a bulletin of the Texas Station, an excessive use of stable manure and other nitrogenous fertilizers should be avoided, as they stimulate a luxuriant growth of foliage and wood at the expense of the fruit.

The fig grows readily and bears early from cuttings. This is the usual method of propagation in the South. Quoting from the above-mentioned Texas bulletin:

> The cuttings are taken during the winter from wood grown the previous season. It is essential that the wood be of the right degree of maturity or the rooting process will not be successful. * * * When the wood is cut the surface of the wound should be moist and covered with small drops of milky white sap. The length of the cuttings depends upon the moisture of the soil. If the soil is quite moist they may be as short as from 4 to 8 inches, but if the surface soil be dry they must be long enough to extend down into the moisture, if it be 2 or more feet. Cuts should be made just at the joint, at both base and top. This is important, for the fig has a solid stem at the joint, but has a pith in the center of the stem between the joints which quickly decays, and the wood will always die back to the first joint. If decay once starts it is very likely to extend beyond the first joint and destroy the cuttings. * * * Insert the cuttings to the top bud in rich, moist, well-drained land. It is essential that the soil be well packed at the base of the cutting, for if an air space be left the cutting will likely shrivel without rooting.

Where the climate is too severe to plant the cuttings immediately in the open, they may be bundled and buried until spring, as with

grape cuttings. It is frequently advised that the cuttings be planted in the site the tree is to occupy permanently, as the fig is often severely set back by transplanting. When transplanted to the orchard from the nursery row the roots should be carefully protected from drying out. It is well to plant two or more cuttings in each tree position. This will tend to lessen vacancies in the orchard, and the excess number can be taken out later. Planting distances differ with the varieties grown, and with varying soil and climatic conditions. Available figures indicate that 12 by 16 feet, with every other row removed when the trees begin to crowd, will be sufficient for most varieties. This would leave the permanent planting 16 by 24 feet.

No general system of orchard cultivation has been worked out for the fig in the South. Some advocate as little culture as possible, since the fig is a shallow feeder. If the preparatory plowing as well as subsequent cultivations are made as deep as is consistent with the nature of the soil in each case, the roots will be encouraged to feed more deeply and the danger from mechanical injury confined largely to thin soils.

On the thin soils which abound in many parts of the Southeast it is difficult to cultivate without doing serious injury to the roots. Earle suggests "mulching heavily near the tree with any available material that will hold moisture and keep down the weeds. * * * The middle of the rows can be kept clean by a shallow plowing and harrowing without disturbing the mulch and without injury to the roots protected by it." When the weeds and grass are not allowed to get too big a start, the small-toothed cultivator or an acme harrow will prove efficient tools for surface culture. The practice at the Texas Station, where the soil is a heavy clay loam, has been "to disk the orchard lightly at frequent intervals during the spring and early summer to keep down the weeds and conserve the moisture." This method proved satisfactory for tree growth.

Frequent pruning is considered detrimental to the fig tree. The quality of the fruit is not improved and the quantity is usually decreased thereby. The general advice is given to prune only sufficiently to shape the young tree, to remove all injured wood, and to thin out the head of the tree to admit air and sunlight. All cuts should be made at a joint, and as a rule the branches or canes should be completely removed, rather than stubbed back. When a branch is only partially removed, the numerous shoots forming below the cut make the head irregular in shape and necessitate more pruning later on. Where the fig is to be grown as a standard tree, pinching back the leader during the growing season will hasten the development of the lateral branches. The use of low branching standards to shade the soil is advisable in sections where long-continued

droughts occur. The same effect may be produced by starting two or three main stems from the ground. The latter form of tree is less liable to break down under a heavy crop. In colder sections, where the bush or stool form is grown, pruning should be limited chiefly to the removal of weak or injured canes.

The Celeste, Brown Turkey, and Brunswick appear to be the three most widely grown general-purpose varieties. The prospective grower, however, will be assisted in the choice of varieties for different purposes and sections by consulting "Varieties of Fruits Recommended for Planting."[a] He should also seek the advice of the State experiment stations and of local practical growers, since varietal names are not the same in all sections and, furthermore, well-known varieties are held in different esteem in different sections. The Celestial or Celeste is preferred for canning in the northern Gulf coast region, while a variety locally known as the Magnolia but said to be identical with the Brunswick grown at the Texas Station, is largely used for canning in the coast region of that State.

The fig has thus far been relatively free from insect pests and fungus diseases in the South. Relative to maladies in Georgia, Starnes writes, "its worst enemies appear to be wet weather and fruit depredators such as birds, junebugs, wasps, and other insects." The birds, he says, "pay their score most royally by the destruction they visit upon insects injurious to other crops. * * * Fungus affections are fortunately few and do not affect a great amount of damage, if we except the operation of the ferment producing the fig 'sour,' which is almost always a concomitant of prolonged wet weather. A leaf rust sometimes prematurely defoliates the trees, but does not do much harm." Although the cotton root-rot fungus (*Ozonium auricomum*) is said to occur on the fig, no particular damage from this source has been thus far reported.

The nematode *Heterodera radicicola*, a minute worm which causes the disease known as root knot by infesting the soft fibrous roots, thrives best in moist sandy soils, and is more or less troublesome throughout the entire coast region. Starnes advises the use of the mattock as the best remedy for this trouble. "Figs develop so rapidly that a vacancy is soon filled, and the chance of the malady, whatever it may be, involving the rest of the plat, is thereby reduced. Yet it is well to be first assured that some actively injurious agency and not deficient nourishment is the operating cause. Therefore on noting any apparent weakness or deterioration the sickly individual should receive a top-dressing of nitrate of soda. If this fails to renew

[a] U. S. Dept. Agr., Farmers' Bul. 208.

its vigor and the tree still maintains an abnormal appearance, grub it out and renew."

The remedy advised by J. C. Neal in a previous bulletin of this Department,[a] which consists of draining the land thoroughly and applying tobacco dust mixed with unleached ashes or lime, is reported as having been tried with success in some sections of the Texas coast country. The orchard should be planted on land known to be free from the pest, and truck crops should not be grown between the rows, as they are nearly all subject to root knot.

The fig-tree borer (*Ptychodes vittatus*) has caused some trouble in certain parts of Louisiana and Mississippi. Of this pest W. C. Stubbs, of the Louisiana Stations, says:

> The damage done in Louisiana is to a large extent conjectural. In our groves we have lost several trees temporarily, all being bored into by this borer. They, however, start up again quickly from the roots and soon replace the injured trees. We have had no remedy against this invasion except to dig it out while very young with a penknife. We have tried various insecticides without apparent results.

During long-continued rainy weather or in wet soils the crop often sours on the tree. Aside from attention to drainage and using care not to overirrigate, little can be done for this trouble.

The fig should be thoroughly ripe when picked for immediate home consumption, and only a trifle green when picked for shipment. Quoting from a bulletin of the Georgia Station—

> It must be picked fully ripe to be worth eating and can not be gathered prematurely, like the peach or plum. But a day's wilt somewhat improves its quality and increases the sugar content, provided it is carefully handled. After twenty-four hours, however, the danger line is reached and fermentation is imminent. It must therefore be handled rapidly as well as tenderly. * * *
>
> Gathering the fig is a difficult and clumsy process when the fruit can not be reached by hand from the ground, on account of its very soft character. It is almost as troublesome to gather safely as is the persimmon, and the slightest fall ruins it. * * * Yet the fig tree, while possessing brittle wood, and therefore not to be climbed, is fortunately not lofty, as a rule, and its fruit is readily reached by the help of a stepladder. From the ground the fruit may be conveniently reached by means of a home-made "gatherer" or "fig cup," constructed very simply by tacking a baking-powder can to a pole of any desired length, first filing a portion of the rim of the can to a cutting edge. For horizontal work—reaching out from the ladder for distant fruit—a modification may be made by tacking the can to a pole at a right angle to it, like a dip net.
>
> Shipping must be effected in either berry cups or extremely shallow trays—preferably the former. The standard 24-quart strawberry crate is the best package to use. Only nearby markets are practicable.

[a] U. S. Dept. Agr., Div. Ent. Bul. 20.

Sufficient has been said in this article to indicate in a general way the possibilities and cultural requirements of the fig for the South. It should be borne in mind, however, that there are as yet no extensive fig orchards in that region and that every such planting will be, to a large extent, an experiment in which the individual planter must work out questions pertaining to soil, climate, and varieties as well as many of the details of cultivation. In general it may be said that, other conditions being equal, the farther South the fig is grown the greater will be the chance of success.

PURE CULTURES IN MUSHROOM GROWING.[a]

As pointed out in a previous Farmers' Bulletin,[b] the use of pure or tissue cultures for mushrooms has developed as a result of investigations of this Department. There are now several commercial kinds of these cultures. The use of pure cultures in this case, as in case of butter making, cheese making, and other processes, results in greater uniformity and certainty of the product.

F. A. Waugh, of the Massachusetts Station, compared pure-culture spawn with English and French spawn in mushroom culture during two years under ordinary conditions and found that pure-culture spawn is, as a rule, very much better than either English or French spawn, but that there are important points of difference between the commercial pure-culture varieties. These differences consist in color, flavor, form, and, above all else, in productivity.

In all of the experiments pure cultures gave larger yields than either the English or French spawn.

"It seems to be one of the chief advantages of the new method of growing mushroom spawn from pure culture that it nearly always gives fresher and more vigorous spawn. The product is nearly always more uniform and of higher quality; but, while this advantage is important, it is not so great as the one already mentioned."

As a general result of his experience in mushroom culture, Professor Waugh expresses the opinion "that mushrooms can often be grown profitably as a catch crop in cellars or under greenhouse benches where conditions are favorable. The most important favorable condition to be considered is a cheap and reliable supply of fresh horse manure. It is quite plain, however, from our experience, that the stories of sudden wealth accumulating from mushroom growing are mostly fictitious."

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[a] Compiled from Massachusetts Sta. Rpt. 1906, p. 208.

[b] U. S. Dept. Agr., Farmers' Bul. 204.

PRESERVING WILD MUSHROOMS.[a]

In a bulletin of the Oregon Station, E. F. Pernot urges that "while the growing of mushrooms is an easy matter, requiring but little time and attention, we must not neglect to utilize the abundance which grow wild, requiring only the effort of gathering and preserving them for future use." He states that mushrooms "may be canned as easily as fruit and much easier than some vegetables."

The buttons ranging in size from the smallest to those with the cup breaking from the stem are the most desirable for canning, as they remain firm and white after being heated. When sufficient buttons are gathered they are cleaned by peeling, or by wiping with a cloth, removing any soiled spots or earth which may have adhered to them; the stems are cut off, leaving from one-half to 1 inch remaining attached to the cap. They may then be placed in a granite-iron kettle and heated without water until shrinkage ceases, after which they are placed in cans that have previously been cleaned and scalded, and the liquor poured over them, completely filling the can.

If glass cans are used, after filling they are placed in any kind of vessel provided with a cover and containing a small amount of hot water. A sheet of asbestos or a thin layer of excelsior is placed in the boiler to prevent the glass coming in contact with the bottom. The caps are placed loosely on the cans and with steamer cover in place allow the water to simmer for half an hour. Upon removing the cover from the steamer, immediately screw the can covers down as tightly as possible, then place the cans away to cool, upside down, in order to detect any leak. If all are perfectly sealed, allow them to stand until the next day at the same time, when they are again heated in the same manner, except that the time must be prolonged to one hour, because the contents of the cans are cold. Repeat this operation again the third day, which will complete the sterilization, and the mushrooms will be found to be as nearly like the fresh article as it is possible to have them. They keep well and do not deteriorate in consistency nor flavor. The cans must be kept sealed throughout the operation.

If desired the mushrooms may be stewed in milk, or prepared in any manner for the table and then canned in the manner described. When the can is opened they require heating only before serving.

When tin cans are used they are handled in the same manner as the glass ones, with the exception of soldering the lid as soon as the can is filled, leaving the vent open until after heating the first time, when it is immediately closed with a drop of solder while can is hot, thus forming a partial vacuum that takes up the expansion caused by subsequent heatings.

This method of sterilizing kills the vegetative germ cell at the first heating, and the intermission between heatings induces the spores to germinate into cells, thus enabling a much lower temperature to be used than what would be required to kill the spores.

If it is desirable to sterilize the mushrooms at one operation, the cans should be filled as already described and, after sealing, heated to a temperature of 240° F. for thirty minutes. This, however, requires a steam chest capable of withstanding a pressure of over 15 pounds to the square inch and is not commonly found in the home; besides the flavor and texture of the article being

[a] Compiled from Oregon Sta. Bul. 98.

canned is materially impaired by this high temperature, and glass cans can not be used.

When the older mushrooms are used for canning they reduce very much in bulk, becoming mushy and turn black after being heated. They do not present such a tempting appearance, but the flavor is not impaired.

A good use to make of the older mushrooms is to dry them. This may be done after they have been peeled or cleaned by placing them upon boards, or drying racks, only one deep, and exposing them to the sun and air. Beginning with the cap side down they should be turned over every day and must not be left out during the night, as they absorb moisture very rapidly. They may also be dried upon wooden trays in a warm room. When dried by either method until they feel dry to the touch, finish them in the oven and while brittle grind them into a fine powder with a spice mill, or even a coffee mill will answer the purpose. The powder should at once be placed into well-stoppered, dry bottles or fruit jars well sealed and kept in a warm, dry place. Mushrooms that are wet can not be successfully dried. The best are those which grow and are gathered dry.

Mushroom powder keeps very well and it is one of the most delicious flavoring condiments of the kitchen. If milk is used in making meat gravy or other dishes, the flavor is much more pronounced.

The mushrooms may also be dried in the manner described and used whole by first soaking them before preparing the various dishes; they are practically the same as fresh ones with the exception of being somewhat tough. The flavor is fully as strong as in fresh ones.

Mushrooms in various stages of development will be secured at each gathering, but these may all be utilized. "The buttons of various sizes may be canned, those with caps fully opened and firm may be dried and used whole or made into powder, while the older ones, those which have been broken, and stems, are made into catsup."

The author recommends the following recipe for making catsup as one which preserves the flavor and keeps well after the bottles are opened:

Take all the mushrooms that can not be used for canning and drying, or all good ones, if desired, place them in an earthen jar and sprinkle salt over them, stirring so that all receive the salt; allow them to stand for twelve hours; then mash and strain through a cloth. For every quart of the liquid add one-half teaspoonful ground ginger and one-half teaspoonful black pepper. Boil in a granite iron kettle until it is reduced not less than one-third. Prepare the bottles by cleaning and thoroughly boiling them and their corks, then fill to the neck with hot catsup, cork tightly and when the cork has dried and before they are cold, dip the cork and about half an inch of the bottle neck into hot canning wax, previously melted in a cup or can. It is advisable to use rather small-sized bottles so that the contents may be used before remaining open too long.

Attention is called to the fact that in "some seasons, and under certain weather conditions, mushrooms are infested with insect larvæ, unfitting them for use in any form. They are most always found where the cap joins the stem and can easily be seen by breaking off the stem where they are localized at that point. In later

stages they will be found to infest the cap and stem. The buttons are less likely to have them than the more mature fungus."

The variety of mushroom referred to in the above directions is the common pink-gilled field mushroom (*Agaricus campestris*). This variety the author states "may readily be recognized by a child without fear of obtaining a poisonous one."

It first appears in the form of a white ball, or button, connected by a stem which extends into the earth; as it increases in size the cap expands from the lower side and a veil which connects it with the stem is torn, leaving a ragged membrane adhering to the stem. The cap is covered with a rather tough skin which may be peeled off quite readily. The gills vary in color from a delicate pink in the young growth, to a deep brown as they mature; they are not attached to the stem. The stem is white, smooth, and brittle, with the lower end somewhat pointed and blunt. When young it is as good to eat as the cap. No mushrooms having a bulb or cup on the lower end of the stem should be eaten.

The food value of mushrooms has been discussed in a previous bulletin of this series.[a]

COOKING BEANS AND OTHER VEGETABLES.[b]

In connection with the home economics work at the Ontario Agricultural College, Miss M. U. Watson reports the results of tests in cooking dried beans and vegetables.

Beans.—Four samples of beans, each lot weighing 8 ounces, were soaked in lime water containing 0.03 per cent lime, in hard water from the local supply, in the same water softened by boiling and also by the use of bicarbonate of soda, in the proportion of 1 teaspoonful to a gallon, the work being undertaken with a view to ascertaining the effects of hard and soft water upon the quantity of cooked beans. After twelve hours the samples soaked in softened water each weighed 12.75 ounces, those soaked in lime water and hard water 12.25 and 12.5 ounces, respectively, and it was found that the smallest amount of material, 1.8 grams in round numbers, had been removed from the beans soaked in water softened by boiling, and the largest amount, 2.5 grams, in the beans soaked in water softened with bicarbonate of soda.

Each lot of beans was then cooked for three hours in a double boiler and showed some differences in quality and appearance. The smallest amount of protein removed, 3.6 grams, was noted with the beans which had been soaked in water softened by boiling, and the largest amount, 5.4 grams, in those which had been soaked in water containing bicarbonate of soda.

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[a] U. S. Dept. Agr., Farmers' Bul. 79, p. 18.

[b] Compiled from Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 33 (1907), p. 240.

In general, the beans soaked in softened water absorbed more water than the others and consequently increased more in weight. Three hours' cooking at the simmering point did not soften and disintegrate the cellulose of beans cooked in hard water, and such beans the author considers neither palatable nor digestible.

The harder the water in which beans are cooked for a given length of time, the more unpalatable and indigestible the beans, and the more protein lost in cooking.

Beans cooked in water softened by boiling have, the author states, a much more appetizing appearance than those cooked in water softened by baking soda. They keep their shape better and are only very slightly colored yellow. They are also more mealy and "would therefore be most digestible, as the saliva could most easily mix with the particles of the bean."

The author therefore considers that the beans cooked in water softened by boiling were the most palatable and nutritious, while at the same time they lost least of their nutritive constituents in soaking and cooking.

"As seen in this experiment, the best results are obtained by cooking beans in water softened by boiling."

Strong-smelling vegetables.—In tests which were undertaken to learn the best methods of cooking strong-smelling vegetables to secure a palatable product and to avoid odors in the house, half-pound samples of cabbage and onions were cooked in salted and unsalted water in covered and uncovered pots. It was found that when the vegetables were cooked by simmering in a close-covered pot less steam was formed than when they were boiled vigorously, and of this steam little escaped into the room, and consequently there was less odor noticeable than under the other experimental conditions. Vegetables cooked by simmering in a covered pot had also a much better color than the others. The best results were obtained when salt was added before cooking. If added afterwards the flavor was more insipid. More substance was dissolved out when salt water was used, but as the author notes, "we do not depend on cabbage or onions to give us food substance, so the little loss is not of much importance."

The general conclusion reached is that "the best method of cooking strong-smelling vegetables is to simmer in a covered pot in salted

A MODEL KITCHEN.[a]

At a housekeepers' conference held at the Agricultural College of the University of Missouri, the experiment station exhibited a full-sized model of a convenient farm kitchen. As pointed out by Dr. Edna D. Day, of the home economics department, in her account

[a] Compiled from Missouri Sta. Cir. Inform. 30.

of this project, it is essential that the necessary routine work of the home should be made easy if the home maker is to have time, energy, and enthusiasm for her home life, and there is perhaps no place in the home where more unnecessary time and energy are expended than in the ordinary kitchen, owing to faulty planning and inconvenient construction and furnishing. In this model kitchen an effort has been made to secure economy in steps taken and in the time and energy required for housework. The diagram (fig. 3) shows the general plan of the kitchen, its position in relation to the pantry, dining room, and other rooms, and the location of the range and other kitchen furniture.

A floor covering of oilcloth or linoleum is suggested as desirable, since it can be kept clean easily by mopping, and it does not require hand and knee work with a scrubbing brush. For best wear the more expensive sort is preferable, but even a cheap floor covering, which needs very frequent replacing, is, in Miss Day's opinion, preferable to a wood flooring, which needs more scrubbing. "An oiled hard-wood floor is easily cleaned, but dark and unattractive. Tiling is clean, but harder for the feet than linoleum." A sanitary wall covering in imitation of tiling is recommended, which is applied like ordinary wall paper, and which is comparatively cheap, easily cleaned, and attractive. It must be carefully hung so that there may be no cracks or other hiding places for vermin. Metal tiling is perhaps more sanitary, but is also more expensive. It is, however, cheaper than true tiling and perhaps as satisfactory.

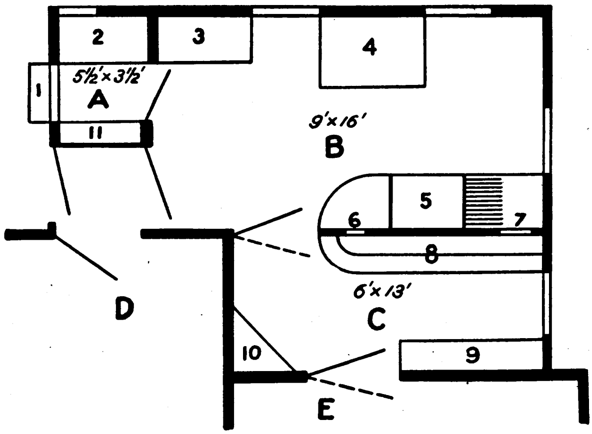

FIG. 3.—Plan of a model kitchen (scale: ⅛ in. is 1 ft.): A, Cold pantry; B, kitchen; C, butler's pantry; D, back hall; E, dining room. 1. Window box to be used to keep food material in cold weather. 2. Refrigerator with outside door for icing. 3. Kitchen cabinet. 4. Range. 5. Sink with shelves and draining board on either side. 6. Door for passage of soiled dishes from pantry into kitchen. 7. Door for clean dishes to be passed back. 8. Shelves in pantry. 9 and 10. Shelves with glass doors. 11. Shelves in cold pantry.

In this model kitchen a model kitchen cabinet, which provides many conveniences and has the advantage of grouping working materials at hand where they are needed, is placed where there is

good light, next to the stove, on the one hand, and to the cold pantry, on the other, with the sink at the back. The stove is also placed where light is abundant.

The easily cleaned refrigerator, in the conveniently placed cold pantry, has an ice door that can be reached from the outside, saving the kitchen floor the dripping and footprints which generally mark the iceman's path. Outside of the pantry window is a box in which food can be kept cold many months in the year without the use of ice. If well finished and painted the color of the house on the outside, this need not mar the exterior appearance of the house. The shelves in the pantry afford room for storing food materials.

The small table on rollers can be moved into the cold pantry for pastry work, when the kitchen is too hot. It can conveniently find place between the kitchen cabinet and stove when frying or other cooking makes a table at that point convenient. In kitchens where sink and china closet are far apart, such a table saves many steps at dish-washing time. In this kitchen the lowest shelf of the china pantry is convenient for the reception of dirty dishes from the dining-room table. Here they can be scraped and piled and passed through the window on to the shelf at the right of the sink.

A window at the end of the drain board gives light for the dish washing and allows, if the view be good, a chance for inspiration during the mechanical work of dish wiping. The window into the cupboard over the drain board may be made small, allowing simply for the passage inward of the piles of clean dishes, or may be made large enough to give access to the back of all the shelves in that part of the pantry, allowing each dish to go directly from the dish towel to its place on the pantry shelf. The opening may be closed with glass or wooden doors.

At the farther end of the kitchen is a place for the ironing board near to both stove and windows, but entirely out of the way of other workers in the room. It may be hinged to the wall at one end and folded up into a wall cabinet when not in use. Inclosed shelves below may give place for the irons, holders, and wax. The heights of the ironing board, sink, and table should be suitable to the height of the worker. A high stool can be used to advantage at the sink and kitchen cabinet. Every kitchen should have at least one comfortable chair. Since at best many hours daily must be spent in the kitchen, its arrangements and equipments should be such as to make the work there as easy and as attractive as possible.

Some of the visitors said that the kitchen was too small for a farm, but those who had had experience both in a small, conveniently arranged kitchen and in a large one in which miles must be walked in doing the ordinary day's work, were in favor of the compact arrangement.

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